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ABSTRACT

The report considers ways of using television for instruction of blind, partially sighted, deaf, and hard of hearing children (5 to 16 years old). The introductory section reviews characteristics associated with the four types of handicapping conditions. The use of videorecorders, captioned programs, and closed circuit television is considered. Recommended equipment requirements and modifications are made, including adaptations of the color television receiver, slow scan replay equipment, lip shaped waveform display, and a braille transducer. (CL)

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IBA RESEARCH FELLOWSHIP

Television for Certain Handicapped Children — Phase 1

Improving the Effectiveness of TV Programmes for Certain Handicapped Children

by
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London

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FOREWORD

This report is based on a period of work (July 1976-April 1979) carried out on a part-time basis to study means of improving the effectiveness of television programmes to blind, partially-sighted, deaf and partially-hearing children in the age range 5 - 16 years. In practice, work done investigating these children's handicaps may well result in providing help to persons outside this age range, but the main concentration of effort has been confined to this 5 - 16 years-old age group.

On the 19th May 1978 a one day Seminar was held on Educational Television for Partially-sighted and Deaf Children[1] at the IBA, Brompton Rd., London. The meeting was chaired by Mary Warnock and attended by Lady Plowden, Chairman IBA, teachers, educationalists and others interested or involved in the subject.

The object of the Seminar was to present to the meeting the results of the study to date and to discuss these with the participants. The exchange of views expressed during this meeting and the discussions were most helpful and contributed much to help the completion of Phase 1 of this study.

A change of attitude of recent years by society has shown a large measure of concern for the less fortunate citizens and an obligation to ensure that they should be helped to develop their potential to the full and to be accepted within the ordinary community.

There is a view strongly held by many concerned with education, that it is the right of every handicapped child to be educated alongside normal children in ordinary schools. Whilst this investigation is not primarily concerned with determining whether special schools or special units in ordinary schools are used, it needs to take cognisance of the fact that both methods are in use and are likely to remain for some years yet.

The first part of this report seeks to identify the special television audience that the study is aimed at, whilst the second part deals with identifying their problems. From the information gained from discussions with teachers, members of interested organisations, Universities engaged on training staff or engaged in relevant research, opthalmologists, audiologists etc. a field trial is proposed to encompass the points arising from this initial study.

The main work of the proposed field trial is based on the use made of broadcast television programmes with possible technical modifications not affecting the normal viewers. It is proposed however to include in the field trial the use of closed circuit television and possibly certain selected television educational programmes transferred from video tape to Super 8 mm film as a way of complementing the use of educational television and this point is referred to in more detail in Sections 2 and 3. The use of other visual aids is not ruled out.

The final work of the study will contain the results of the field trial and conclusions and recommendations.

LIST OF ILLUSTRATIONS

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Section 1

IDENTIFYING THE AUDIENCE

"Tis education forms the common mind
Just as the twig is bent the tree's inclined"

Alexander Pope, Moral Essays.

There are four main categories of children that this investigation is primarily concerned with - the blind, the partially-sighted, the deaf and the partially-hearing. To separate them from each other and from other handicaps that each may have is difficult but nevertheless important.

An attempt therefore has been made to identify and quantify the number of children in these categories who could benefit from using television as a teaching aid and then to indicate any modifications to equipment which might help each category of child. Other children such as the educationally sub-normal (ESN(M)), slow learners, "delicate" etc. but having normal sight and hearing might very well also benefit.

Although I cannot claim that my investigations have been exhaustive, examination of the figures of the incidence and prevalence of the handicaps over the past thirty years suggest that the present pattern of figures is likely to remain relatively stationary unless disturbed by some social factors that are not foreseen. In any case, the totals are so small compared with the total child population that only changes of several orders of magnitude would significantly affect the study and such changes certainly are most unlikely.

1.1 The blind and partially-sighted

Although this part of the investigation concerns mainly the partially-sighted, the blind and the partially-sighted are linked together in official statistics as well as confused with each other in peoples minds. There are at least 67 different definitions of 'blindness' in use round the world[2]. Although most countries can agree a definition of total blindness as "an inability to perceive light in either eye', they have not agreed a

definition of blindness which is less than total and which affects at least nine times as many people. It is important to attempt to differentiate between the totally blind and the partially-sighted in this particular investigation because the two groups follow quite different educational patterns. In this report the totally blind child has not been investigated because their very special education and training uses quite different methods - excluding television - from the other categories of handicapped child considered.

The following definitions have been used in an attempt to understand and hence separate the abilities of the two categories, the blind and the partially-sighted.

Blindness - National Definition[3] - a person is registerable as 'blind' if he is so blind as to be unable to perform any work for which eyesight is essential. This disability refers to any work and not just to his own occupation and it must be distinct from any other disability of mind or body. The degree of visual handicap which is represented by this definition is usually taken to be a visual acuity of less than 3/60 in the better eye.

The Partially-sighted - those who are substantially and permanently handicapped by defective vision resulting from illness, injury or congenital disease may be described as 'Partially-sighted'.

For registration purposes and for the provision of welfare services a person may be registered as 'partially-sighted' if his visual acuity (i.e. the best direct vision obtainable with each eye separately or with both eyes together as tested with Snellens Test Type), with the focus properly corrected, is:-

a. 3/60 - 6/60 will full field of vision

b. 6/24 or less with moderate contraction of the visual field, opacities in the ocular media, or aphakia (absence of crystalline lens)

c. 6/18 or better if there is gross visual field defect such as pigmentary degeneration of the retina and glaucoma.

Reference above has been made to standards of vision and it may be helpful to readers to note the principles involved in estimating visual acuity.

The size of an object is measured that can be defined at a standard distance usually 6 metres (20 ft.). If the eye under test can see the object designed to be seen at 6 metres the visual acuity of that eye is 6/6. If, however, at a distance of 6 metres the eye being tested is only able to distinguish the object that a normal eye can just see at 60 metres then the visual acuity of that eye is expressed as 6/60. Thus the numerator represents the distance under which the test is being conducted whilst the denominator represents the distance at which the test object (usually a letter) is designed to be read, so that a scale of visual acuities can be constructed ranging from perfect vision 6/6, 6/5 to 6/9, 6/12, 6/18, 6/24, 6/36 to 6/60 or less. It will be noticed that the above only takes into account distant vision whereas a knowledge of reading vision is also important, particularly in this investigation. For this test N notation reading test type is used and both eyes are used together. Those classified as partially-sighted would be unable to read any lower figures than N36 at a reading distance of 10-15 inches, whereas persons with normal sight would be classified N5 or N6. Newsprint is normally N8.

Having given the definitions it must be said that there are many cases when it would be wrong to reach a decision on classification on the basis of prescribed visual standards alone. Social, economic and psychological factors all have an important bearing on the degree of handicap. This is particularly so in the case of children in the age groups considered by this study[4].

Visually handicapped persons can be classified into one of the following three groups:-

Group 1	Those who have been born with a visual handicap or in whom one occurred in early infancy; those who have become visually handicapped in early childhood or during their school days	before formal education has been completed
Group 2	Those who have acquired a visual disability during their active and working years	
Group 3	Those who become visually handicapped late in life	

In this study only Group 1 is considered.

As at the 31st March 1976 there were 5112 blind and partially-sighted children in the UK in the age range 5 - 15 years[5]. Of these about 90% (4600) were attending schools and so could be helped by this investigation. Sadly about half of the blind and a third of the partially-sighted children can be expected to have additional handicaps[6].

1.2 Visual Defects

In order to appreciate the loss of function or visual defects encountered, particularly in children, classifications based on the 'presenting visual effect' as described by the patient are suggested. Fig. 1.1 illustrates normal 6/6 vision. The observer has to imagine he is looking at the centre of the picture - approximately at the position of the right ear of the man in the centre of the picture.

1.3 Suggested classifications of visual defects

Central vision loss

Examples of conditions causing this defect are:-

i. Optic atrophy
ii. Macular degeneration
iii. Myopic degeration

Fig.1.2 illustrates the effect of central vision loss.

Field loss

Examples of conditions causing this defect are:-

i. Retinitis pigmentosa
ii. Infantile Glaucoma (Buphthalmos)
iii. Detachments
iv. Coloboma

Fig.1.3 illustrates the effect of field loss.

Degraded image

Examples of conditions causing this defect are:-

i. Albinism
ii. Uveitis
iii. Corneal dystrophies

Fig.1.4 illustrates the effect of degraded image.

With this method of classification a better appreciation of how sight is affected is obtained and of how modifications to television receivers and/or additional equipment might help to improve the understanding by the child with defective vision.

1.4 The Deaf and Partially-hearing

The terms 'deaf' and 'partially-hearing' are used to describe the type of education required by a child and do not necessarily refer to the child's degree of deafness. For the purposes of this investigation the following definitions have been used[7].

a. deaf pupils, that is to say pupils with impaired hearing who require education by methods suitable for pupils with little or no naturally acquired speech or language

b. partially-hearing pupils, that is to say, pupils with impaired hearing whose development of speech and language, even if retarded, is following a normal pattern, and who require for their education special arrangements or facilities though not necessarily all the educational methods used for deaf people

There are two main types of deafness, conductive deafness and perceptive (or nerve) deafness. Conductive deafness is mechanical, when the ear canal or the ear drum or the small bones in the middle ear are blocked, broken or seized up. Perceptive or nerve deafness (more usually these days referred to as sensorineural deafness) is caused by faults in the neural system that transmits information from the inner ear to the brain. Fig. 1.7 shows a diagram of the main sections of the human ear and Fig. 1.8 is an example of a normal pure tone audiogram.

To illustrate the definitions used above to describe the type of education required by deaf children, Fig. 1.9 shows the pure tone audiograms for two 'deaf from birth' children who are profoundly deaf and who receive little benefit from hearing aids. Both children are being educated in schools for the deaf. Fig. 1.10 shows the audiograms of two more 'deaf from birth' children who are classified as partially-hearing, one is being educated in a normal school and the other in a partially-hearing unit of a normal school - both use post aural aids. Pure tone audiograms give a good

indication of the degree of deafness but the ability to understand words and sentences depend on other factors such as subject, whether lip reading can be employed, age of child and so on. Fig. 1.11 shows the sound intensity of everyday sounds with the degrees of deafness.

There are many hearing-impaired children (for whom no official statistics exist) attending ordinary schools and classes and these include children whose hearing impairment is recognised and who need support from a peripatetic teacher or simply a front seat in the classroom. In addition to the above there are also those who suffer from fluctuating middle ear disorders which they may outgrow.

Statistics for children receiving special educational treatment are published regularly and the latest available are those for January 1975[8]. They show approximately 4500 deaf and 6500 partially-hearing children receiving special education.

The RNID estimates that in addition there are 12,000 hearing-impaired children attending ordinary schools or classes (Linda Shepherd, Information Officer - personal communication).

Section 2

IDENTIFYING THE PROBLEMS

At the beginning of this research, much information was obtained by reading the literature appropriate to the study, talking to doctors, opthalmologists, audiologists, social workers, research workers and to persons attending special courses at teachers training colleges etc. (Appendix 1) engaged in the fields at which this study is aimed. Having learned something of the overall educational objectives for these handicapped children and of their physical and physiological limitations I was able to begin to appreciate some of the likely problems they might encounter with broadcast television programmes. To verify these problems a number of visits were planned to special schools for the deaf, partially-deaf, and partially-sighted (Appendix 2).

In my Research Proposal submitted to the IBA[9] I suggested that the use of standard entertainment techniques in educational programmes is not the most effective way of imparting information to children with hearing and/or visual handicaps. Because of the considerable care taken by the broadcast organisations in monitoring educational programmes for children it is reasonable to assume that they are effective for the normal child in a normal school environment. Can we expect that these networked programmes are acceptable, as they are transmitted, for the handicapped child who has sight and hearing defects and whose rate of learning, vocabulary, experiences etc. are below the standards for the majority of children for which they are made? The quick answer to that question is 'no' but the key words are '...as they are transmitted'. The rate of information is too fast and there are other features that are found distracting to the handicapped child. I hope to show later that by making certain changes in equipments and supplementing existing equipments some of the problems encountered can be minimised whilst still retaining the original transmissions unchanged. Before going into details of the problems encountered it is worthwhile considering the number of children involved.

From Sections 1.1 and 1.2 the number of children in the UK in 1976 who are deaf, partially-hearing, hearing-impaired, blind or partially-sighted is estimated to be 27,600. Approximately half of these

are receiving education in special schools or units whilst the remainder is an RNID estimate of hearing impaired children in ordinary schools. The Plowden Report[11] stated (para 845) the good school 'is not only right for the normal but right for the handicapped for their fundamental needs are similar, though there may be differences in the way they are satisfied'. Indeed it is DES policy that 'no child should be sent to a special school who can be satisfactorily educated in an ordinary school'.[12]

So it is reasonable to assume, but difficult to quantify, that there are a number of children in ordinary schools that could benefit from the results of this investigation. However, even if this number is twice that of the deaf, partially-hearing, blind and partially-sighted children receiving education in special schools (or units) the total (55,200) only represents 0.6% of the UK School population of 9 million. As is so often the case with minorities, they are the ones needing the most help and in the case of these handicapped children it is particularly true for, typically, they are often two years behind normal children in basic education at the end of their formal schooling at 16.

2.1 General Observations

By visiting schools, talking to teachers and pupils it soon became evident that educational television programmes play an important and useful part in the handicapped child's education. Equally so, however, all schools I visited said that they found the programmes were transmitted at times inconvenient to their own time tables. Those schools that had video recorders used them to overcome this problem but I believe them to be in the minority. Those that did not have video recorders missed many programmes that they would otherwise have liked to have watched. All schools again said that the programme material was presented too quickly for the children to understand. Again this problem is overcome in schools that have video recorders by repitition, but not by slow replay.

The use of video recorders in schools has been reported before. Hayter[13] states 'By far the most significant development reported was the free and flexible use of broadcasts afforded by recording facilities. Where these exist there is no longer the necessity to arrange 'a preparation' and a 'follow up' around a programme fixed in time - rather, the programme is taken when a planned piece of work has

developed to a certain stage which has constituted the preparation: the three stages have merged, the programme becoming an integral part of a unified learning situation'. Later in his report he remarks 'Many other organisational advantages are noted, perhaps the most common being the opportunity to have repeated hearings or viewings, partial or in their entirety, to support or supplement the content of developing work as and where the need arises'.

The use of relatively sophisticated equipment does however bring its problems. In the schools I visited the use of all audio visual aids tended to be 'under the wing' of an enthusiastic teacher - if that teacher moves away from the school the equipment tends to be used less and it seemed to me that some training of teachers in the use of audio visual aids <u>including</u> mono/colour television receivers, recorders etc. would be advantageous. There is a comment in the Annual Report 1975/76 of the NDCS[14], making specific mention of this point 'There is still cause for concern over the maintenance of equipment used in schools and units. This equipment, often extremely expensive, falls into disuse or is not used correctly to the benefit of the child'. Again Hayter comments on the necessity of training teachers in the use of schools broadcasts when he states 'Using broadcasts well is no easy task. There is a clear need for teachers during their pre-service education and training to become aware of the range and availability of broadcast material, and of the many ways in which it can be used to enrich the learning situation. The considered use of broadcasts among other resources is an undoubted stimulus to the in-service training of teachers within the school. Their experiences so acquired could make a valuable contribution from which they themselves would benefit, to the courses of in-service training conducted by Local Education Authorities and other local and national bodies'.

I found that the teachers engaged in teaching the handicapped children would welcome a 'resources officer' or person who would see that equipment was available when required, arrange for film to be in cameras etc. and thus leave the teacher more free to carry out the task of 'teaching'. This in no way implies criticism of the teachers as will be seen from my report later, indeed they were doing all tasks and everywhere I went I was welcomed and given the most positive help I could wish for.

Another general point concerned the two distinct types of programme that teachers use. The first is topical or one that demands a response based on the

present time of transmission, whereas the second type is more lasting and timeless, such as nature programmes. The latter type can be used term after term and it is in this field that I think transfer to Super 8mm film for showing on a cassette type projector is to be recommended. The costs are relatively low and the life of the film long compared with using videotape; and it also provides a useful correctly colour-balanced programme for schools without recording or colour television facilities.

It is worth stating again that out of the 150 or so special schools and units catering for the handicapped investigated by this report, relatively few have colour and/or recording facilities (Appendix 3). It is largely a question of money not being available from Local Authorities to provide equipment; equipment that everybody I've spoken to regards as absolutely ideal for teaching handicapped children. Many schools rely heavily on Parent/Teacher Associations to provide equipment but with colour video recorders and an adequate supply of video tapes costing about £800 it is not hard to understand the reason for lack of equipment, particularly where the schools concerned have typically 100 pupils. Nevertheless, my investigations show that television educational programmes would be significantly more effective in this handicapped group if more equipment was available.

2.2 The Problems of the Deaf and Partially-hearing

In many programmes for schools a presenter is used and the comment I received from all teachers was that if only the presenter would face the camera and speak clearly then the children could lip read Key words and benefit more from the programme. Since these programmes tend to be ones in which the children are asked to do or make things, when they can't hear they get very frustrated.

Another comment was that background music and 'cocktail background talk' is most distracting and teachers will often turn off the sound and give their own commentary accompanied by captions written on blackboards or flip charts. One headmaster of a school for the deaf used an overhead projector focussed onto a sheet of white paper attached to the bottom of the TV set. By previously playing through the recorded programme from his reel-to-reel monochrome recorder he prepared his handwritten captions onto a roll of transparent acetate. Then he sat on the floor, having first started the recorder to replay the programme, and hand-operated the roll during the showing of the programme so that the captions he had written came on when he

wanted them. It may be a little Heath Robinson but it is typical of the determination I found amongst those teaching the handicapped. It is certainly the cheapest form of caption storage device I know but it makes one think that, with all our modern technology, surely we could make the production of captions easier. The majority of teachers of the deaf were emphatic that ideally they would want to control the writing of the captions - only they knew the words that their children could understand and captioning from a central service could confuse rather than help in educational programmes. Some teachers also made the point that, because of the children's difficulty in reading, if they had to continually read captions they would be distracted from the picture so much that they would lose more than they gained.

However, I should report that the Norwegian Broadcasting Service does caption educational programmes for deaf children and this is accepted by teachers to be satisfactory. Norway and Sweden were the only countries I found (in a not-exhaustive study) that had carried out research into finding how best to arrange captions for deaf children (Hans Birkrem Norwegian Schools Television, N.R.K and Bertil Allander, Sveriges Radio - personal communications).

I should also mention that in the Annual Report of the NDCS the following paragraph appeared on p.12 'A demonstration had been given by the BBC of Ceefax, the dial a page news and information service, and the Committee (Technical Committee NDCS) in agreeing that the limited service was not of great value to deaf children felt extensive captioning of programmes would be extremely helpful'.

I must say that I feel strongly that we do not know enough about this subject; many teachers, indeed the majority, have never seen Oracle/Ceefax (Appendix 3). Therefore I believe that a field trial should be arranged to determine the best way to use captioning from a central point for deaf children. The trial to include such items as how many letters per line, how many lines per caption, capitals or lower case, black on white, boxed, position on screen, duration of captions on screen etc (Appendix 4). Since this report was first drafted, such a research programme has been initiated at Southampton University.

In Sweden[15] work carried out on sub-title exposure times to groups of adult viewers showed that 90% of the subjects succeeded in reading the text in between 4.5 - 6 secs. The report goes on to say that deaf people can be expected to have a language handicap that cannot necessarily be compensated for by a larger exposure time to sub-titles.

The teachers interviewed in the UK agreed that central captioning was better than no captions at all for entertainment type programmes.

For children who have some hearing, most schools use an audio loop system and the children 'receive' the television sound on their normal hearing aids with the teacher monitoring on a deaf aid earpeice. Using this method the teacher can, if necessary, interrupt to explain a difficult word by using the classrooms group audio system which is used for teaching purposes.

2.3 The Problems of the Blind and Partially-sighted

From Section 1 it will be seen that a relatively high proportion of these children will have additional handicaps. However, significantly less (between 15 - 20%) will have colour vision defects (Dr. Shirley Fine personal communication). Colour therefore to the large majority is vitally important in conveying information. Unfortunately (as with the deaf) few schools for the blind and partially-sighted possess colour receivers and video tape recorders. Ideally, viewing should be on small screens with 2 or 3 children close to the screen rather than the 9 or so that typically gather round the standard issue 20 inch set supplied to schools. Unfortunately, this latter arrangement generally results in three children seeing reasonably well, three poorly and three probably not at all.

The use of closed circuit television plays an important part in the education of those children who are fortunate enough to have a unit in their school. It is used as a magnifier of books, sheet music, documents etc. but more use could be made of such an aid if more units were available. The units I have seen are fixed in one location which restricts their use. I feel that there is a case for greater use of this type of low vision aid for normal class work. I understand that their use is more widespread in the USA. In addition to magnification a degree of contrast enhancement can also be achieved over direct viewing. One of the equipments used extensively in the US gives up to 60 times magnification of the original material. A typical example of use of this sort of aid is the ability the child has of writing under the camera and seeing his handwriting clearly. With the more usual optical low vision aids, magnifications of the order of 3, 10 or 20 times are typical. In many of these cases, though, the child has to wear a headband with the aids clipped onto the normal glasses or use a telescope monocular or binocular. Yet a further advantage of television is the ability to reverse the polarity of the picture, this could be important as there is some evidence that a white image on a black background is preferable to black on white (Mehr et al and Silver)[16].

PROPOSED STUDY PROGRAMME

The investigations carried out and briefly reported in Sections 1 and 2 of this report lead to recommendations for a study programme and, if approved, will form the basis of an experiment lasting initially for six months. From the results obtained from this experiment, recommendations will be made that, it is hoped, will result in a more effective use of television in the teaching of the types of handicapped children covered by this report; there is the possibility that results would be applicable to slow learning children.

3.1 The Scope of the Study Programme

In order to evaluate various ideas an experiment is proposed based on those requirements of teachers which appear to be technically feasible without incurring great expense; some engineering work is called for which requires resources not available to the writer. It is recommended therefore that a school be selected for the experiment and that as many ideas and equipments as possible are evaluated over a six month period. After analysis of this experimental study, then we anticipate that a more condensed programme of implementation could be carried out in a representative sample of schools, leading to firm recommendations for future equipment designs.

The help of the IBA Education Department will be sought in selecting the schools and the Research Department in the way in which the study should be arranged. Since much of the evidence on whether the study is effectively helping to solve the problems will be based on subjective assessment, special precautions will need to be taken in recording and analysing the results (see 3.4 Method of Approach).

The experiment and study programme needs to recognise the differing requirements of the blind and partially-sighted from the deaf and partially-hearing children in respect of equipment. It is suspected, however, that some recommendations could help both groups and the proposed pilot study is constructed bearing this point in mind.

3.2 Equipment Modifications and Requirements

It is recommended that the following equipment requirements/modifications are implemented in order to initiate the pilot experiment which is planned to form the first part of the study programme.

3.2(a) Colour Television Receiver

The following technical changes at the receiver appear technically feasible, although they require implementing and are thought to be potentially helpful in teaching handicapped children:

i. Modification to scanning circuits to give a two or three times magnification at the centre of picture

ii. Artificial over-correction of picture edges to accentuate boundaries between picture detail changes

iii. Exaggeration of mid-tone contrasts at expense of high light and shadow gradation

iv. Provide a suitable external audio output to drive either group hearing aids or an inductive loop system

Ideally, modifications 3.2(a) (i) -(iii) should be under the control of the teacher, so that they can be switched in or out, or their magnitude adjusted, as required.

3.2(b) Lip-shaped Waveform display

Lip reading is used by deaf and partially-hearing children and when presenters turn away from the camera or there is speech from a person or persons not in camera shot problems are caused to the viewer. It might be useful therefore for the sound to be displayed alongside the receiver in the form of a 'lipshaped' waveform. The purpose of this display would be to help to convey to the viewer the basic lip form of the predominant sound just as though the speakers lips were in camera - a prototype equipment has been developed by D.W. Boston, RNID, London[17]. Basically the equipment produces a lip on an oscilloscope or television screen the shape of which approximates the lip outline of a mouth while a person is speaking.

3.2(c) Slow Scan Replay Equipment

There is a requirement for a device that would provide a slow-motion replay of the picture, of a minute or half-minute duration, preferably without alteration of sound pitch. This unit could be used directly off-air, or in conjunction with a video tape recorder, as a means

of repeating a sequence in slow motion to give the children time to appreciate an important point.

3.2(d) Captions and Teletext

As was to be expected, investigations made and reported in Sections 1 and 2 show that great use is made of captions in the education of deaf children. Some teachers show considerable ingenuity in providing captions and it should be possible to use Teletext to assist teachers in this important teaching aid. The response of teachers to the suggestion that Teletext should be used was somewhat surprising and disappointing. There was almost unanimous opinion that only the teachers concerned knew the words that their children would understand and therefore only they could provide the captions - this is technically feasible, but expensive.

Of the 70 schools replying to a questionnaire only 13 had seen a demonstration of Teletext (see Appendix 3).

It is proposed therefore to invite the help of the ITCA to provide dedicated Oracle pages, on an experimental basis, for deaf and partially-hearing children watching certain selected educational programmes (Fig.1.6) These text pages would need to be prepared by a teacher and here the help of the Department of Education would be sought in finding a suitable person. In addition, pages listing key words only should be prepared and allocated to timed multiple pages; in this manner some of the objections against captioning from a central source voiced by the teachers might be overcome in that text could be displayed at times determined by the teacher and the display held, within limits, for as long as required. Bearing in mind the teacher's desire to provide their own captions it would be desirable to investigate the possibility of providing a simple local caption generator. The generator output could be used to record onto audio cassettes and thence to a television receiver fitted to accept slow-rate Prestel/Teletext, or it could be fed directly to the receiver.

3.2(e) Optical Captioning Equipment

As an alternative to 3.2(d) it is worth investigating the possibility of providing an optical captioning device that would project lettering directly onto a television screen or onto a 'screen' immediately adjacent to the television screen.

3.2(f) Braille transducer

It appears feasible to develop a matrix of a number of blunt pins that are raised in accordance with the Teletext signal, allowing the letters to be 'read' by a blind person as they are 'formed' on the matrix.

3.3 Future Study Considerations

In addition to the initial experiment outlined in this Section there are a number of other developments that should be considered. These developments are based on new technologies that are relatively expensive at present but since the products employing these new technologies are aimed at consumer markets their price is expected to fall quite significantly within the next 2 years.

3.3(a) Telesoftware

The word means 'software at a distance' and it refers to the transmission of computer program signals for a microprocessor via broadcast Teletext[18]. It is reasonable to assume that within five years an increasing number of new television receivers equipped for Teletext display will be in use in schools. The Teletext decoder that each of these sets contains has the elements of a small computer, a memory (page store), character generator, display circuitry, numeric key pad etc. With a small addition to the Teletext decoder circuitry simple 'games', programmes employing multiple choice questions etc. could be available off air. The first phase of experimental work on two types of programme, Mastermind and a calculation of mortgage repayments, has now been satisfactorily completed and the next phase is planned for later in 1979.

By adding a little more terminal equipment (presently about the size of existing domestic video tape recorders) 'programmes' can be recorded onto Type C audio cassettes as well as any selected Teletext signals (broadcast Oracle/Ceefax or Post Office Prestel) to be replayed whenever required. This would allow a considerable degree of flexibility in the use of Teletext/Telesoftware; one of the most important factors being that the use of the recorded information can be used when, and as often as, the teacher considers it necessary - a point that was made many times during this investigation. Another important factor in the use of Type C cassettes is that they are inexpensive to purchase, easily sent through the post, familiar to staff to use and can be played over and over again with little or no degradation of signal.

It is my belief that this development area will contribute considerably to education in the immediate future with particular application to handicapped children in this report.

3.3(b) Closed circuit television

Although there are at present a number of closed circuit television (CCTV) systems in use (see Appendix 3) they are not as good as nor as useful as they could be and an amount of system design is necessary. The work involved would require resources not available to the writer, but only known technology is required. It is recommended that any work on a CCTV system be undertaken with the help of the Low Vision Aids (LVA) Clinic at Moorfields Hospital who have had experience in this area and are dealing daily with blind and partially-sighted children referred to them for assessment and the provision of Low Vision Aids.

Whilst the provision of low vision optical aids plays an important part in helping the blind and partially-sighted child to learn, television has certain advantages that optical aids cannot provide. These advantages are:-

i. greater magnification than is obtainable with an optical aid

ii. enhancement of contrast range

iii. ability to reverse polarity so that the choice of black on white or vice versa is available to the teacher

With the improvement in photo-conductive camera tubes and associated components, CCTV should form a useful aid for teaching handicapped children.

3.3(c) Speech-Synthesis Learning Aids

Speech synthesis, which has been in the development stage for years, moved forward recently when Texas Instruments introduced a learning aid, designed to improve children's spelling; they named it 'Speak-n-Spell'. The device is aimed at 7 year olds, and has, at present, the capacity to store about 200 words. The operation of the machine is simple; it is a self-pacing device. The machine speaks the word to the child, and the child then attempts to spell the word on a key board. The technology on which it is based has great possibilities for the future for helping to teach slow-learners.

In the suggestions for further work outlined in 3.3(a) - (c), the emphasis is to provide aids that are under the control of the teacher - the desirability of this feature has emerged strongly throughout this study.

3.4 Method of Approach

The writer does not have the resources or the experience to carry out a long term study in measuring the effectiveness of learning of groups of handicapped children using the various modified equipments suggested in this section. However, a method of approach is suggested for a trial that would give definite indications on which to base further experiments.

The large number of variables involved make it impossible to measure the effectiveness of learning over a short period of time and therefore difficult to reach conclusions concerning the next stage of experiment. Because of this situation it is more important to make sure that the teachers are happy and conversant with the equipment to be used and, most importantly, feel that there is a need for it to assist them in their job. To explain this last point, briefings would be held at each school selected and the teachers told exactly what it was planned to achieve. From the discussions following the briefing a questionnaire would be drawn up with relevant questions suggested by the teachers. The full co-operation of the teachers would ensure their involvement in filling in the questionnaire and in feeling that they were helping to create and be a part of the trial. After the questionnaires are completed and analysed we would seek the opportunity to report back to the teachers and invite their help in making proposals for further trials. Thus the results of these small trials in certain selected schools would form the basis of proposals for Phase 2 of this study with conclusions and recommendations for further work.

The following schools have been tentatively approached and have expressed their willingness to take part in such an experiment subject to final confirmation:-

Oak Lodge School for the Deaf
101 Nightingale Lane
London SW12

Joseph Clarke School
Vincent Rd.
Highams Park
London E4 9PP

Special Unit for partially-hearing
in the Harrow area to be selected
by Mrs. Deidre Heath, teacher in
charge of deaf

It is planned that each 'experiment' should last for a term but the trial periods would not necessarily run concurrently. The actual number of trials will depend on the availability of the equipment but it is anticipated that a minimum of two schools would be involved probably monitoring results on two programmes per week.

3.5 Code of Practice

It is envisaged that as a result of these developments and the pilot experiment, a brief pamphlet could be published that would be of help to directors of programmes, giving "Do's" and "Don't" highlighting the special requirements of the handicapped, whilst not significantly detracting from the enjoyment of the majority of normal viewers (see Appendix 5).

▼ **Figure 1.1** Normal 6/6 vision – the observer has to imagine he is looking at the centre of the picture, approximately the position of the right ear of man in centre.

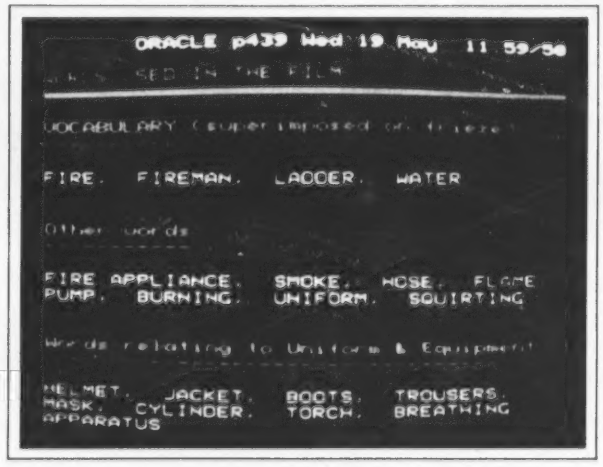
▼ **Figure 1.2** Simulation of macular degeneration – central vision loss.

▲ **Figure 1.3** Simulation of advanced retinitis pigmentosa – field loss.

▲ **Figure 1.4** Simulation of degraded image.

Pictures 1.1 to 1.4 supplied by the Institute of Ophthalmology.

▼ **Figure 1.5** Painting 'New York' by boy of 11 with macular degeneration. Visual acuity R.6/24 L6/36. Colour deficiency – complete Red/Green and difficulties with darker ranges of other colours.


ORACLE p439 Wed 19 May 11 59/30
FIRE. FIREMAN. LADDER. WATER
FIRE APPLIANCE. SMOKE. HOSE. FLAME
PUMP. BURNING. UNIFORM. SQUIRTING
HELMET. JACKET. BOOTS. TROUSERS.
MASK. CYLINDER. TORCH. BREATHING
APPARATUS

▶ **Figure 1.6** Example of how Teletext could be used to assist deaf children by displaying key words.

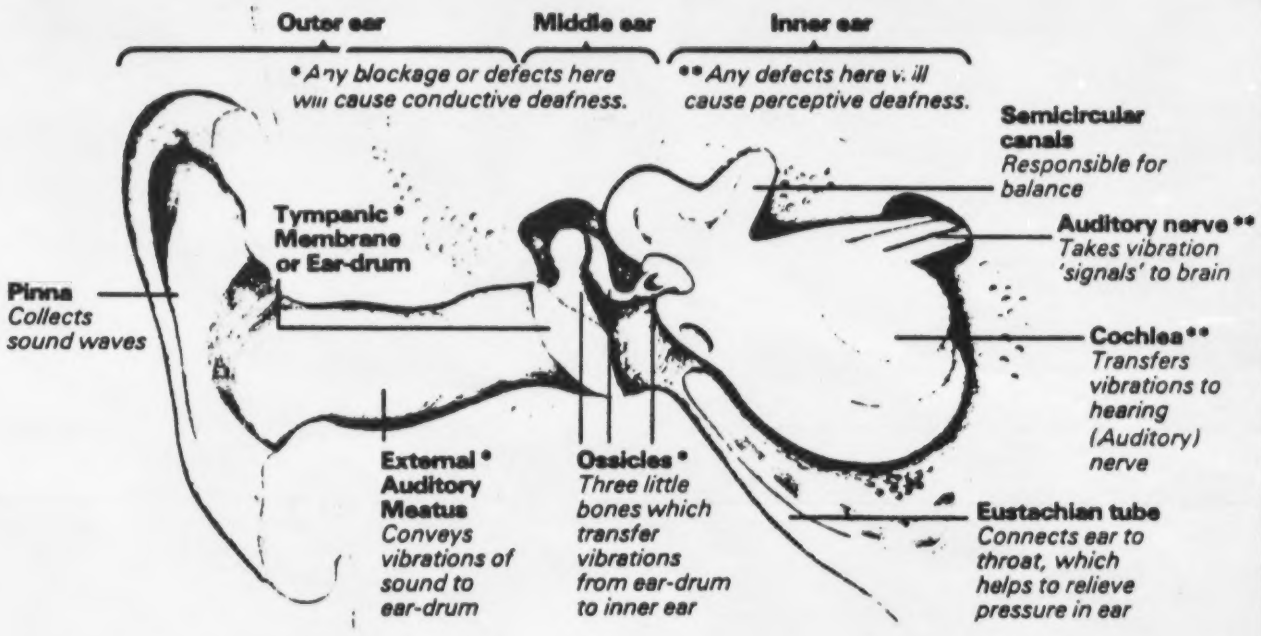

Outer ear
Middle ear
Inner ear
* Any blockage or defects here will cause conductive deafness.
** Any defects here will cause perceptive deafness.
Semicircular canals
Responsible for balance
Auditory nerve **
Takes vibration 'signals' to brain
Tympanic * Membrane or Ear-drum
Pinna
Collects sound waves
Cochlea **
Transfers vibrations to hearing (Auditory) nerve
External * Auditory Meatus
Conveys vibrations of sound to ear-drum
Ossicles *
Three little bones which transfer vibrations from ear-drum to inner ear
Eustachian tube
Connects ear to throat, which helps to relieve pressure in ear

Fig. 1.7 Diagram of the human ear showing the main parts and their function. (Courtesy RNID from their publication "Hearing Aids").

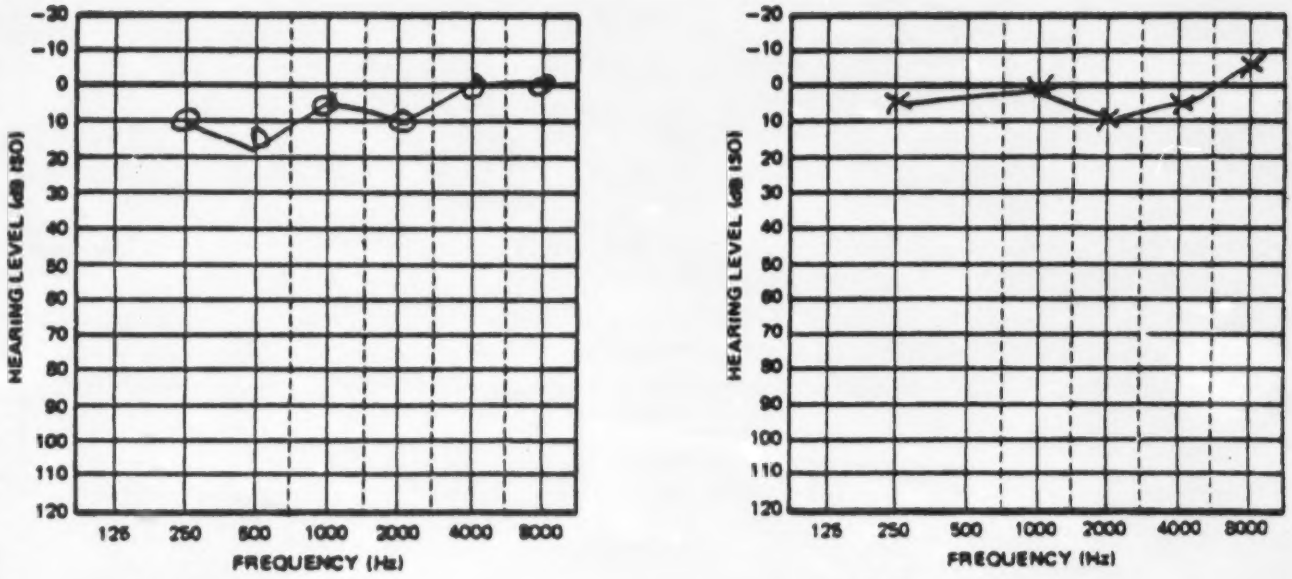
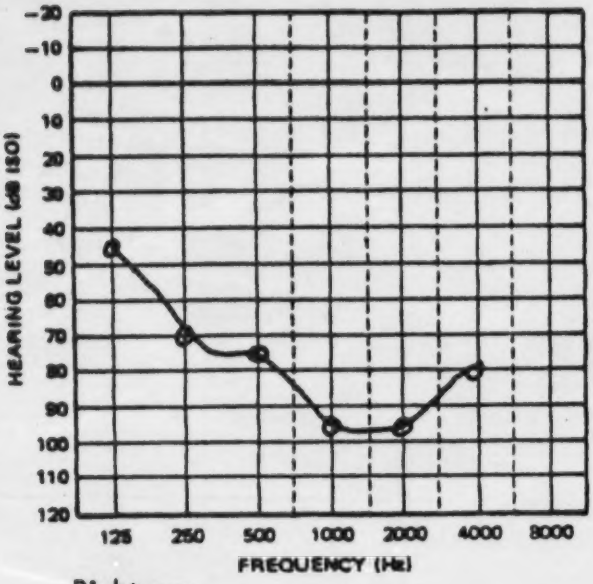
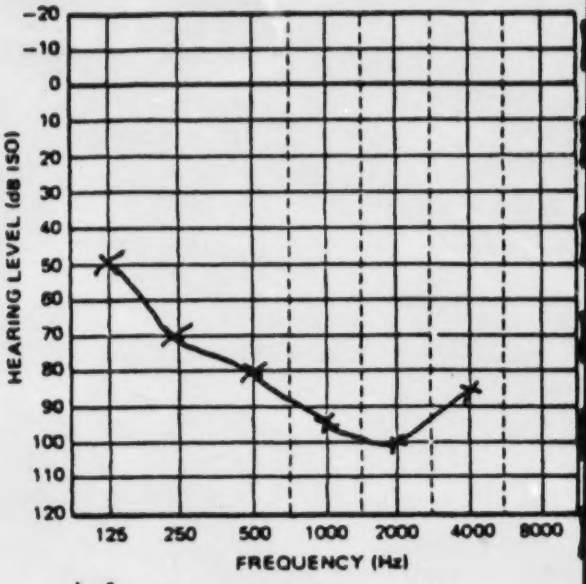


Fig. 1.8 Example of a normal pure tone audiogram. Note that the curve does not lie directly along the '0' db line.

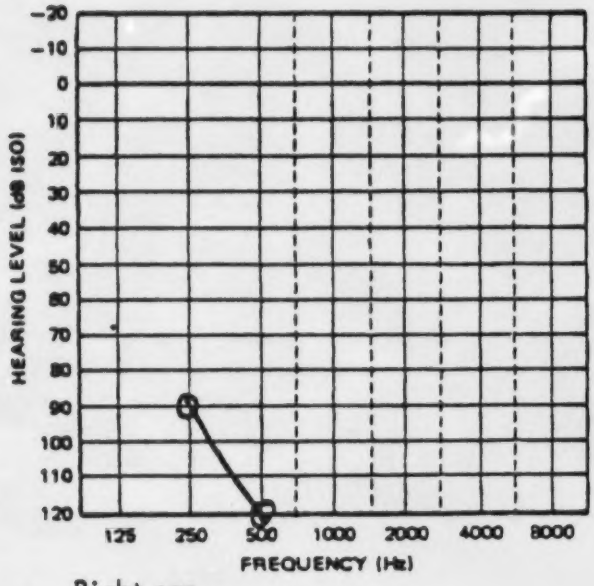


Right ear

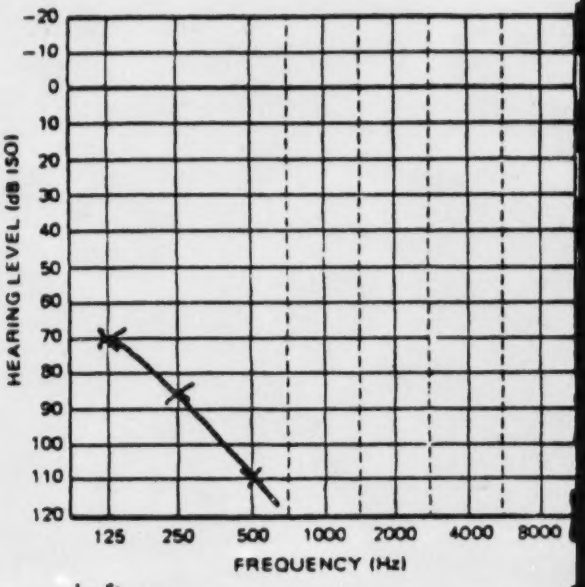


Left ear

B.P. Age 13 Deaf from birth - poor speech production. Powerful body worn hearing aid used. In school for the deaf. Reading age 8 years.



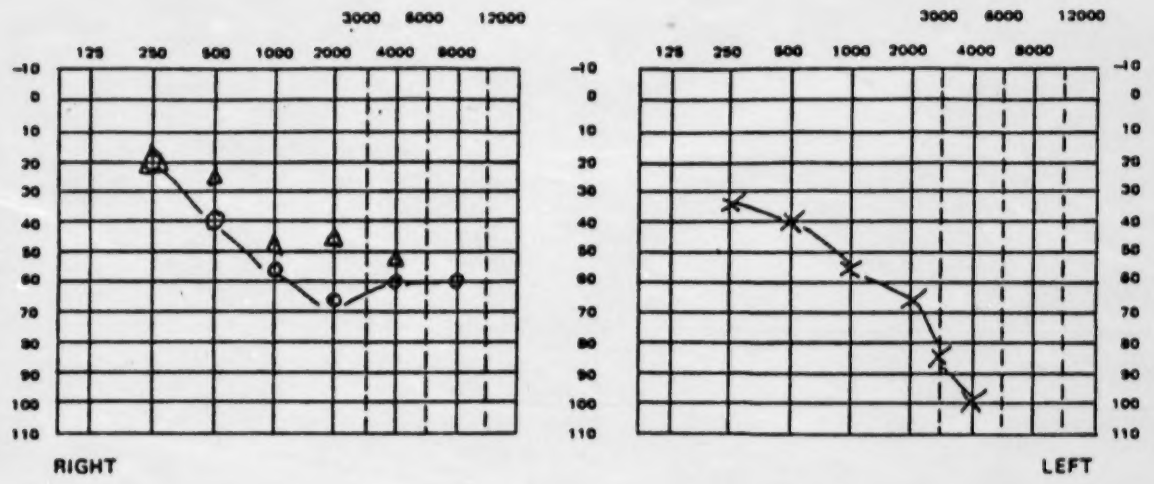
Right ear



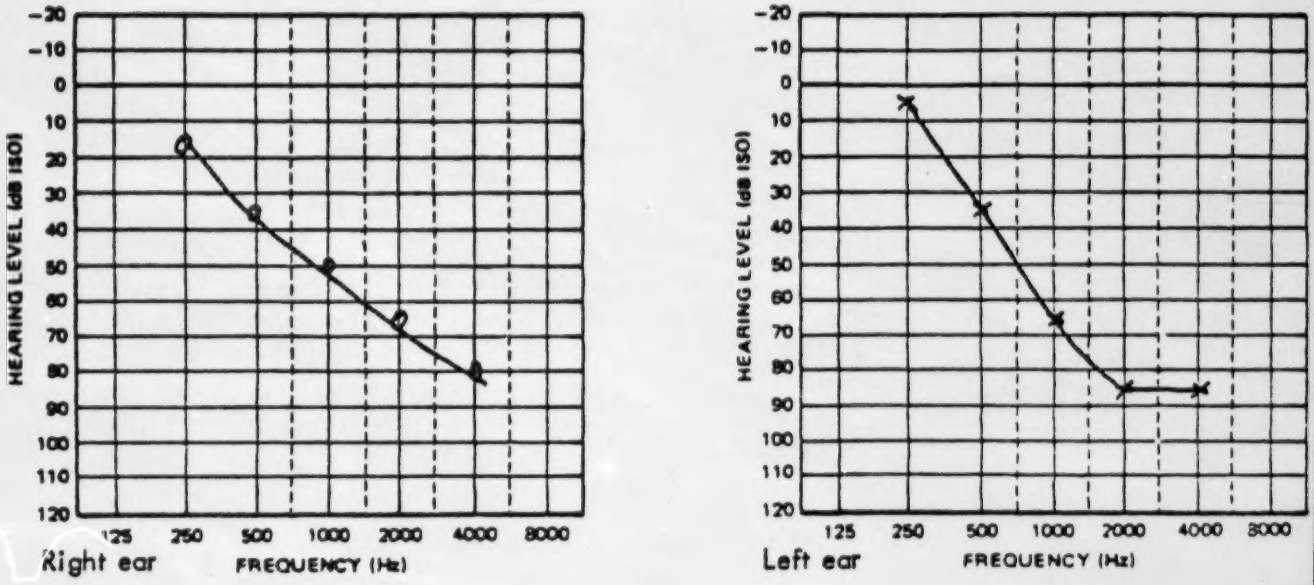
Left ear

D.G. Age 13 Deaf from birth - unintelligble speech - most powerful hearing aid used but little value. In school for deaf - reading age 6 years.

Fig.1.9 Pure Tone Audiograms of two profoundly deaf children.

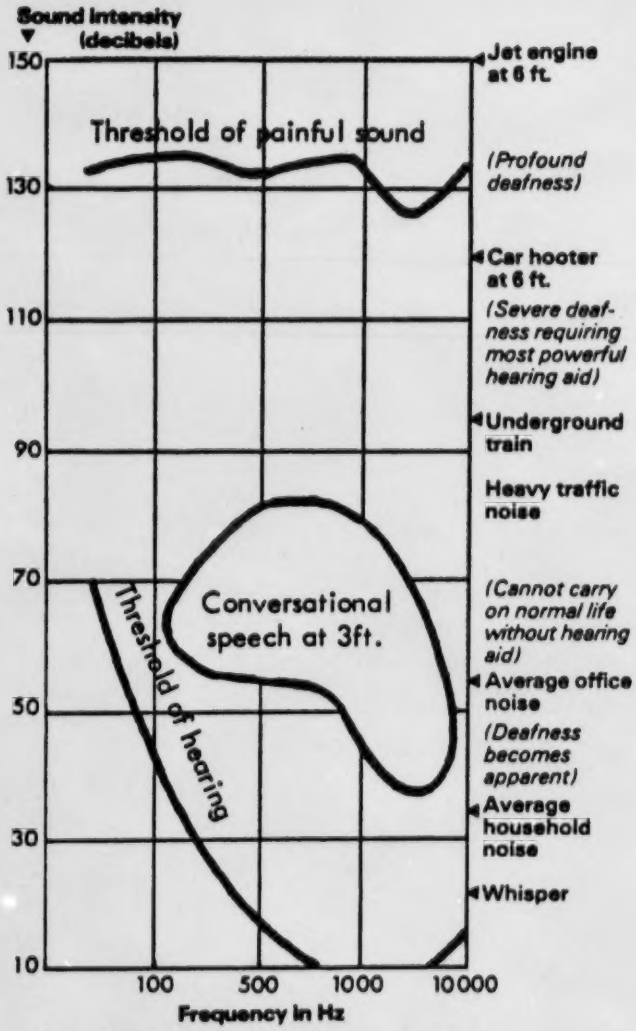


M.S. Age 7 Deaf from birth - good speech production, uses post aural aids. Being educated in normal school - normal reading age.



L.F. Age 14 Deaf from birth - good speech, uses post aural hearing aid. Being educated in partially-hearing unit - normal reading age.

Fig. 1.10 Pure tone audiograms of two partially-hearing children.



This refers to the pitch of the sound. Some examples of everyday sounds at these frequencies are:

100Hz	*QE2 foghorn*
500Hz	*Lower tone of two-tone ambulance siren*
2,000Hz	*Train going round sharp bend*
10,000Hz	*Bat squeak*

Fig. 1.11 Intensity levels of everyday sounds with degrees of deafness. (Courtesy RNID from their publication "Hearing Aids").

Appendix 1

UNIVERSITIES, COLLEGES, INSTITUTIONS, AUTHORITIES etc. contacted

Oxford Polytechnic
The Lady Spencer-Churchill College
Wheatley
Oxford OX9 1HX

Dept. of Educational Development
University of Oxford
Course for Teachers of Deaf and Partially-hearing Children.

Janet Silver, M.Phil., FBOA
Principal Opthalmic Optician
Moorfields Eye Hospital
City Rd.
London EC1V 2PD

Dr. A.F. Newell
Dept. of Electronics
University of Southampton
Southampton SO9 5NH

W.H. Snowden
Dept. of Education & Science
Elizabeth House
York Rd.
London SE1

Dr. Tim Cullinan
University of Kent
Health Services Research Unit
Cornwallis Building
The University
Canterbury CT2 7NF

Prof. R. Gulliford and Elizabeth Chapman
Faculty of Education
University of Birmingham
Ring Rd. North
Birmingham B15 2TT

Roger Fletcher
Institute of Opthalmology
Judd St.
London WC1

Dr. Shirley R. Fine, Sylvia West and Claire Brooke-
Hughes (Social workers)
Dept. of Health and Social Security
Alexander Fleming House
Elephant and Castle
London SE1 6BY

M.C. Martin
Head of Scientific & Technical Dept.
Royal National Inst. for the Deaf
105 Gower St.
London WC1E 6AH

Dr. I.W. Kemp
Scottish Health Service
Common Services Agency
Trinity Park House
South Trinity Rd.
Edinburgh EH5 3SQ

Dr. E. Turkington
DHSS Work Unit
Stoney Rd.
Belfast BT4 3FX

Mrs. Wilson
DHSS
Arlbee House
Greyfriars Rd.
Cardiff CF1 35B

Mr. Myers
Dept. of Health & Social Security
42 Weston St.
London SE1 3QW

Dr. J.D. Armstrong
Blind Mobility Research Unit
The University of Nottingham
Dept. of Psychology
University Park
Nottingham NG7 2RD

Royal National Institute for the Blind
Gt. Portland St.
London W1

Hans J. Birkrem
Norsk Rikskringkasting
Bjornstjerne Bjornsons Plass 1
Oslo 3
Norway

Bertil Allander
Sveriges Radio ab
105 10 Stockholm
Sweden

Appendix 2

SPECIAL SCHOOLS VISITED

Nutfield Priory School
Nutfield
Nr. Redhill
Surrey — Headmaster: K.S. Faragher

Ovingdean School for the Partially-hearing
Greenways
Ovingdean
Brighton BN2 7BJ — Headmaster: B.W. Phillips

Joseph Clarke School
Vincent Rd.
Highams Park
London E4 9PP — Headmaster: R.J. Crosbie

Hamilton Lodge School for the Deaf
Walpole Rd.
Brighton BN2 2ET — Headmaster: J. Jansen

Nansen School
Welton Rd.
London SE1 — Headmaster: J.B. Pope

Grove House School for the Deaf
Elmcourt Rd.
London SE27 9BZ — Headmaster: R. Hill

Exhall Grange School
Wheelwright Lane
Coventry CV7 9HP — Headmaster: G.H. Marshall

Appendix 3

TELEVISION EQUIPMENT SURVEY - Object and Analysis of Results

The object of this survey was to obtain an estimate of television equipment used in schools and special units for the blind, partially-sighted, deaf and partially-hearing. At the same time the opportunity was taken to ask other questions which were relevant to the present study. A copy of the questionnaire sent will be found on page 31.

BLIND AND PARTIALLY-SIGHTED

Number of schools surveyed: 54 Number of forms returned: 36 67%

Answers to questions

1. Equipment
   - Number of schools with monochrome receivers: 30
   - Number of schools with 2 or more monochrome receivers: 17
   - Number of schools with colour receivers: 26
   - Number of schools with 2 or more colour receivers: 11

2. Television recorders
   - Reel-to-reel (monochrome): 4
   - Reel-to-reel (colour): 1
   - Video cassette (colour): 4

3/4. Closed circuit television systems
   - Monochrome: 8

5. Details of ancillary equipment, eg audio/vision mixer
   3 schools had ancillary items

6. Number of schools using Broadcast television as part of normal teaching aids: 28

7. Percentage of timetable devoted to television educational programme viewing
   23 - Range from 1-20% Average 10%

8. If you wished to increase this viewing time what additional equipment if any would enable you to do this?

   11 said extra television receivers
   8 said video tape recorders
   1 said CCTV
   11 said change to colour receivers

9. Seen demonstration of Teletext 3

10. Maintenance of equipment
    Contract 23
    Pay as fault occurs 6

DEAF AND PARTIALLY-HEARING

Number of schools surveyed: 67 Number of forms returned: 34 51%

Answers to questions

1. Equipment
   Number of schools with monochrome receivers 26
   Number of schools with 2 or more monochrome receivers 14
   Number of schools with colour receivers 27
   Number of schools with 2 or more receivers 11

2. Television recorders
   Reel-to-reel (monochrome) 12
   Reel-to-reel (colour) 3
   Video cassette (colour) 12

3/4. Closed circuit television systems
   Monochrome 13

5. Details of ancillary equipment, eg audio/vision mixer
   13 schools had ancillary items

6. Number of schools using Broadcast television as part of normal teaching aids 30

7. Percentage of timetable devoted to television educational programme viewing
   30 - Range from 1-20% Average 5%

8. If you wished to increase this viewing time what additional equipment if any would enable you to do this?

   11 said video tape recorders
   1 said Ceefax
   1 said a specially trained member of staff

9. Seen demonstration of Teletext 10

10. Maintenance of equipment
    Contract 25
    Pay as fault occurs 2
    Own technician 3

TELEVISION EQUIPMENT QUESTIONNAIRE

The following television equipments are available for use in this school.

Equipment		No.	Screen size	Manufacturer
Television receivers:	Monochrome...	...	.....	.....
	Colour	...	.....	.....
Television recorders:				
Reel-to-reel monochrome		...	.....	.....
Reel-to-reel colour		...	.....	.....
Cassette colour		...	.....	.....
Closed circuit television cameras	Monochrome...	...	.....	.....
	Colour	...	.....	.....
Picture monitors	Monochrome ..	...	.....	.....
	Colour	...	.....	.....

Brief details of any other television ancillary equipment, eg vision mixer, audio mixer.

Do you use broadcast television programmes as part of your normal teaching aids. YES/NO

What percentage of your timetable in total is devoted to television educational programme viewing? .....%

If you wished to increase this viewing time what additional equipment, if any, would enable you to do this?

Have you seen a demonstration of Teletext (Oracle/Ceefax)? YES/NO

Is the equipment at your school maintained by way of a regular maintenance contract with a local dealer or a television rental company or how? .....

Any comments you wish to make:

.....

Name and address of school .....

.....

SIGNED: ..... Headmaster/Headmistress. Dated: .....

Appendix 4

Recommendation on the arrangement and use of Teletext for Deaf and Partially-hearing children

From observation and discussion with people concerned with teaching deaf and partially-hearing children in the UK and from correspondence with Norwegian Broadcasting (Norsk Rikskringkasting) it would appear there are two distinct applications for the use of captions. The first is captioning or sub-titling of programmes and the second is the provision of a synopsis of 'key words' on specially designated pages of the Teletext system. Timed multiple pages could be used for this purpose.

In the case of sub-titling of film programme material the characters would appear on the same display screen as the picture and not be under the control of the teacher. If, however, Teletext sub-titling was provided it would be under the control of the teacher to display it or not.

In the second case a separate screen may be used to display the text only with the display under the control of the teacher. Alternatively, the text could be displayed with or instead of the picture on one screen again with control of the text display under the teacher's control. An important point to remember is that it is possible to record programmes with integral captions but it is not practicable to record Teletext characters on conventional video recorders because of the data rate. However, to overcome this important disadvantage it is recommended that the programme is recorded as convenient and that the designated Teletext pages are made available throughout the day. The pre-recorded programme can then be replayed with (or without) Teletext display under the control of the teacher. In both cases editing of the programme script is essential.

Sub-titling

The following recommendations are made for sub-titling educational programmes for deaf and partially-hearing children using Teletext characters:-

a. 1 or 2 lines maximum of text with characters as large as practical. It is preferable to use large lettering and less text to enable these children to read it especially as a number of them are likely to suffer from visual defects in addition to their major handicap of deafness.

b. a maximum of 20 letters per line.

c. the captions should occupy a position at the bottom of the picture. This enables the picture to be looked at first and the eyes travel to the bottom of the picture following a natural reading pattern.

d. the captions should always occupy the same position on the screen.

e. there should be as much contrast as possible between background and captions, black on white or white on black. 'Boxing' helps separate picture from captions.

f. editing and compression of the text and the replacement of words that are likely to be unfamiliar to the children with more commonly used words is essential.

g. captions should be displayed for a longer period than is usual for adults. The pre-lingually deaf or partially-hearing child is better served with a compressed text left for a reasonable period of time than by trying to show too much text for short periods. A maximum of two lines of text requires to be on the screen for 10 seconds for it to be understood and therefore useful to this type of handicapped child.

The above recommendations are intended to serve as a basis for the field trial. It is expected that refinements and additions to the recommendations will emerge as a result of practical experience.

Appendix 5

"DO'S" AND "DON'TS" FOR PROGRAMME MAKERS

My own observations with partially-hearing and partially-sighted children watching television programmes for educational purposes show a close agreement with other observers, Edwards[10], Porter[19].

The main observations are that partially-hearing or partially-sighted children (disadvantaged compared with 'normal' children) are not so able to comprehend facts from a television screen, due to their handicap, as normal children. If a child cannot understand then its attention will wander and be lost, therefore short programme sequences of 10-15 minutes are to be preferred. The teacher can go over the main points again and if the school is fortunate enough to have a video tape recorder then programme sequences can be repeated.

Since it is common practice for teachers to go over sequences again to emphasise an important point, it would be helpful if producers would plan their programmes at the story board stage into one or two minute segments with the slightest pause in both vision and sound thus enabling the teacher to replay the repeated sequence cleanly. The pause need be almost imperceptible and again this attention to detail would be welcomed by teachers of the handicapped and need not detract from the programme's appeal.

Programmes need to be uncomplicated in their presentation with vision directly related to sound. Programmes with background music or 'cocktail' talk (background noise of any kind) serve only to confuse the child and interest is soon lost. Sequences where the sound does not match the visual scene, eg where there is dialogue from a person off the screen to one on, are hard for these children to follow. Other distracting features are the use of special visual effects, quick camera cutting, strange camera angles, flashback sequences, focusing on to a subject before it has been introduced etc. - all these 'gimmicks' that television can provide confuse the disadvantaged child who quickly loses interest. The programmes most liked are ones where the presenter talks directly and clearly (lip reading is used) to the audience - in contradistinction, turning away from the camera (when telling the children how to do something) to reach for a prop is a most confusing action, particularly for partially-hearing children. Movement on the screen is important to keep the attention of the child, providing it is contained within the limitations mentioned.

To many blind and partially-sighted children high contrast scenes are discernible whilst subtle changes of hue tend to appear without distinct boundaries. True colour blindness is always congenital and usually only partial - the most common form is red-green blindness(Fig.1.5). Complete colour blindness, where all colours appear to be greys of a varying degree of brightness, is exceptionally rare. The results of my limited investigation show that, as with adults, male children suffer more than females but more significantly only about 15-20% of children of both sexes studied in this work suffer from colour vision defects. Colour therefore is to the large majority an important factor in conveying information. It is perhaps worth noting that 72% of the schools replying to the survey had colour receivers but only 30% had more than one colour set (see Appendix 3). Directors of programmes could help by noting the points made and ensuring high contrast areas and scenes are used whenever possible, particularly where important information is to be conveyed. Unnecessary 'clutter' of furniture, props etc., particularly in pastel shades, is as distracting to the partially-sighted as 'background' talk is to the partially-hearing and confuses rather than conveys meaning.

It is probably unlikely that special programmes for the partially-hearing or partially-sighted child will be made for regular showing in educational television programmes (indeed there is a strong feeling that this is to be discouraged because it makes the child feel 'different'), but by taking note of some of the points made and applying these to educational programmes generally, the partially-hearing and partially-sighted children would benefit greatly and the normal child would not suffer - indeed they might even be helped. Attention to details at this end of the transmission chain I believe are as important as possible technical changes at the receiving end. In other words, the television medium, whilst not ideal for teaching partially-sighted or partially-hearing children, is not being used to its best advantage.

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Glossary

SOME COMMONLY OCCURRING EYE CONDITIONS IN CHILDREN STUDIED

AMETROPIA - a condition in which there is some error of refraction in consequence of which parallel rays with the eye at rest are not focussed on the retina but either in front of it (myopia) or behind it (hyperopia).

BUPTHALMOS - congenital glaucoma marked by an increase in intraocular fluid with enlargement of the eye ball and causing opacity of the crystalline lens.

CHOROID - the middle coat of the eyeball.

COLOBOMA OF CHOROID - a congenital defect of the choroid and retina seen as a white patch (the exposed sclera) usually situated below the optic disk causing a scotoma in that region.

DIOPTRE - unit of refracting power of lenses denoting a lens whose principal focus is at a distance 1 metre.

HEMIANOPIA - loss of vision for one half of the visual field - quadrantic loss of vision in corresponding halves (right or left, upper or lower) of the retinas.

MACULAR DEGENERATION - is characterised by metamorphopsia - a condition in which objects appear distorted in various ways and by central negative scotoma - which is a scotoma that is not ordinarily perceived but is detected only on examination of the entire visual field.

NYSTAGMUS - rhythmical oscillation of the eyeballs, horizontally, rotary or vertically.

OCULAR ALBINISM - congenital absence of pigment chiefly of the iris and choroid.

RETINITIS PIGMENTOSA - a chronic progressive inflamation of the retina with atrophy and pigmentary infiltration of the inner layers.

SCOTOMA - a spot of varying size and shape within the visual field in which there is no vision.

STRABISMUS - squinting (convergent or divergent)

UVEITIS - inflamation of the entire uveal tract - iris, ciliary body and choroid.